

WHAT IS CLAIMED IS:

1. A solid-state imaging device, comprising:
 - a pixel array having a plurality of pixels arranged in a matrix;
 - each of the pixels including:
 - a photo diode that generates carriers depending on the intensity of incident light;
 - an accumulation region that accumulates the generated carriers;
 - an insulated-gate output transistor that outputs a signal according to a threshold voltage that changes depending on a number of the carriers accumulated in the accumulation region; and
 - an insulated-gate clear transistor that discharges the carriers accumulated in the accumulation region, the accumulated carriers being discharged through a channel region of the clear transistor.
2. The solid-state imaging device according to Claim 1, the accumulation region functioning as a source region of the clear transistor.
3. The solid-state imaging device according to Claim 1, the pixels each further comprising:
 - a pixel-forming region of a second conductivity type that is formed on a semiconductor substrate of a first conductivity type and where one of the pixels is formed;
 - a buried region of a first conductivity type that is formed in the pixel-forming region and that includes a first partial buried region formed at a relatively deep position and having a relatively low impurity concentration and a second partial buried region formed at a relatively shallow position and having a relatively high impurity concentration, a junction region between the first partial buried region and the pixel-forming region forming the photo diode, the second partial buried region forming the accumulation region; and
 - a discharging region of a first conductivity type that is formed in the pixel-forming region and into which carriers discharged from the accumulation region flow;
 - an output transistor that includes a first gate electrode that is formed over the pixel-forming region above the accumulation region through an insulating film; and
 - the clear transistor including a second gate electrode that is formed over the pixel-forming region between the buried region and the discharging region.

4. The solid-state imaging device according to Claim 3,
the first gate electrode having a substantially annular shape; and
the output transistor including:
 - a source region that is formed inside the first gate electrode; and
 - a drain region that is formed outside the first gate electrode.
5. The solid-state imaging device according to Claim 3,
the pixel-forming region including:
 - a lower region that is formed below the buried region; and
 - a side region that is formed at a side of the buried region; and
 - an impurity concentration of the lower region being higher than an
impurity concentration of the side region.
6. The solid-state imaging device according to Claim 3,
the pixel-forming region including:
 - a lower region that is formed below the buried region; and
 - a side region that is formed at a side of the buried region; and
 - a thickness of the lower region being larger than a thickness of the side
region.
7. The solid-state imaging device according to Claim 3,
the first conductivity type being a p-type;
the second conductivity type being an n-type; and
the carriers being holes.
8. A method of manufacturing a solid-state imaging device that includes a pixel
array where pixels are arranged in a matrix, the pixels having a photo diode that generates
carriers depending on an intensity of incident light, an accumulation region that accumulates
the generated carriers, an insulated-gate output transistor that outputs a signal according to
threshold voltage that changes depending on a number of carriers accumulated in the
accumulation region, and an insulated-gate clear transistor that discharges carriers
accumulated in the accumulation region, the accumulated carriers being discharged through a
channel region of the clear transistor, the method comprising:
 - preparing a semiconductor substrate of a first conductivity type that includes a
pixel-forming region of a second conductivity type where one of the pixels is formed and a
buried region of a first conductivity type that is formed in the pixel-forming region, the buried
region including a lower region formed at a relatively deep position and having a relatively
low impurity concentration and an upper region formed at a relatively shallow position and

having a relatively high impurity concentration, a junction region between the lower region and the pixel-forming region forming the photo diode;

forming a first gate electrode constituting an output transistor and a second gate electrode constituting the clear transistor, over the pixel-forming region through an insulating film, the first gate electrode being formed above the buried region, the second gate electrode being formed above an end of the buried region;

leaving the accumulation region having a relatively high impurity concentration below the first gate electrode by utilizing a region including the first gate electrode as a mask and doping an impurity in the upper region, the impurity inverting the conductivity type of the upper region; and

forming a discharging region of a first conductivity type into which carriers discharged from the accumulation region flow, in the pixel-forming region, the discharging region being formed in a region that faces the buried region through the second gate electrode.